

REPORT
OF THE
TUBERCULOSIS SURVEY SUB-COMMITTEE
OF THE
Indian Research Fund Association.



सत्यमेव जयते

July 1940.

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July 31st, 1940.



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Indian Research Fund Association.

Report of the Tuberculosis Survey Sub-Committee

1940.

I. INTRODUCTION.

An early and essential part of a campaign against tuberculosis in any country must be the acquiring of a knowledge about the disease as found in that country, of its prevalence and of the various problems related to it.

Experience in the West has shown that the problem as well as the prevalence of tuberculosis vary greatly in different communities and social groups, in rural and urban populations, in different industries and industrial areas, a multiplicity of factors frequently interacting and influencing these variations. This experience has been largely gained through surveys, and on the information provided by these the campaign has been based.

II. THE STUDY OF TUBERCULOSIS IN INDIA.

In India, at present, our knowledge of tuberculosis studied from the point of view of its manifestations in this country, is extremely limited, and therefore, for some considerable period such knowledge must be accumulated, if the campaign is to have a scientific basis, and only as it is based on real knowledge can it hope to succeed. It is suggested that the best way of achieving this and of obtaining a comprehensive study of the problems, so that their relative importance may be understood and particular problems which need special investigation may be specified and the work to this end directed, would be to consult the Tuberculosis Association of India which might constitute an advisory committee for this purpose.

As in the West, so also here, *surveys* will be the main means of acquiring this knowledge. These surveys will not only be intended

to find out the incidence of infection, morbidity and mortality in particular areas, but also the factors which influence the spread of tuberculosis in India under different conditions, and the role they play, so that a correct perspective of the whole tuberculosis problem may be obtained. Surveys will also show in what way the type of the disease in India varies from the types found in other countries, and whether the same methods of treatment and the same anti-tuberculosis measure can be used here as elsewhere. Surveys will also indicate the location, nature and number of anti-tuberculosis institutions which may be needed to cope with the situation.

It is obvious that if such surveys are to be of their fullest value, and perhaps even of value at all, in the campaign, they cannot be carried out as isolated pieces of work. This committee considers, therefore, that while the collecting of information through surveys may be done by a number of agencies, such as existing official or private agencies, or ones newly started, in their local areas, the full value and the proper co-ordination and scientific assessment of the facts brought out by such surveys can only be done by a central organisation such as the expert body suggested. This memorandum has been prepared with a view to present in a convenient form the main points which are to be taken into consideration in planning a tuberculosis survey so that work done by different bodies in different areas may be capable of co-ordination and assessment.

III. THE BROAD PRINCIPLES OF SURVEYS.

The nature and extent of tuberculosis surveys differ very much according to the object in view and the finances and facilities available. Therefore, some preliminary considerations may be outlined which shall guide the surveys, considerations as to the type of survey to be used, the selection of the area to be surveyed, the data which should be collected and the organisation which should be set up.

(a) Types of Survey.

Tuberculosis surveys can be divided into five main types :—

TYPE I.

This is a survey the object of which, is to ascertain the distribution of tuberculous infection in a particular community or area. At the same time the investigator should note any obvious cases of active tuberculous disease, but it should be remembered that such findings cannot be used for deductions as to morbidity rate.

TYPE II.

This is an extension of Type I survey to include incidence of morbidity and mortality from the disease. The morbidity investigation should include enquiry into the forms and types of disease and the extent of contact infection.

TYPE III.

This is an extension of Type II survey, so as to include investigation into factors influencing infection, morbidity and mortality in the particular area or community.

TYPE IV.

This is a survey, subsequent to a Type III survey, to provide data for the assessing of the value of different anti-tuberculosis measures. The assessing of the results of this type of survey and the deducing therefrom which anti-tuberculosis measures will be most appropriate and effective for a particular area or community in India will largely be the work of an advisory body.

TYPE V.

This is a survey with a limited object of investigating one or more particular problems connected with tuberculosis, either in general, or in a limited community; for example, an investigation to ascertain how far industrialisation affects the tuberculosis problem in India, or whether a particular industry offers special hazards as regards tuberculosis.

(b) Selection of area or population.*

The best way to obtain information about certain characteristics of a population would be to examine every individual included in it, but frequently for various reasons this is impossible. It, therefore, becomes necessary to confine the investigation to a portion of the population. Whether the information so obtained can be applied to the whole group depends on :—

- (1) the way in which the sample is taken.
- (2) the size of the sample in relation to the amount of variation among the individuals.

While recent developments of theoretical statistics have made possible the drawing of the maximum conclusions from the information derived from relatively small samples applicable to the

* A fuller explanation of this section is given in Appendix I.

whole group if the survey is properly designed, these methods are too technical for the average survey worker. There are, however, certain fundamental concepts in sampling, which anyone resorting to sampling must bear in mind :—

- (1) The sample must be representative of the population, *i.e.*, if there are different categories of individuals in the population they should be included in the sample in about the same proportion as they exist in the population.

In examining a particular category of individuals no conscious selection must be made, otherwise the representative character of the sample will be vitiated.

- (2) The sample should be adequate in size, the larger the better. To test the adequacy a number of independent samples may be drawn and their means estimated in respect of the characteristics investigated. If the size is adequate the differences between their means will be insignificant.
- (3) In interpreting the results we should be conscious of the limitations as regards the applicability of the conclusions derived from the samples to the population as a whole. Here again theoretical statistical considerations enter and one who is unfamiliar with these should consult a statistician conversant with tuberculosis problems. If, however, the investigation has not been carried on in the right way from the beginning a statistician may not be able to help in the conclusion, and therefore, the help of a statistician should be enlisted even in the planning of a survey. The Tuberculosis Association of India, New Delhi, is prepared to put those who require such collaboration in touch with a suitable consultant.

(c) The data which should be collected.

In determining what data are to be collected through tuberculosis surveys, there must be certain guiding principles :—

- (a) The data must be such as are directly related to the particular problems of tuberculosis under investigation.
- (b) The methods used must be such that the material can be subjected to statistical treatment so that it will give the maximum value. Therefore, the arrangement of the schedules should be made after deciding upon the exact method which will be followed in sorting and tabulation.

- (c) The units of observation should be clearly defined so that observation similarly recorded by different individuals may convey the same meaning; that is, there should be an exact definition of the object which is enumerated.
- (d) In putting down the sub-groups with regard to any item of information, the classes should be mutually exclusive and should be framed with a view to obtaining the maximum information in relation to the problem under investigation.

While it is possible to formulate broad principles applicable to the whole of India, it will be necessary to give clear instructions as to how information collected in different areas should be recorded under the main headings according to the local circumstances. These instructions could probably best be given by an adviser from the expert body already mentioned.

For analysing the data mechanical methods will be preferable. There should, therefore, be a central agency to analyse the data obtained in different parts of the country.

The actual items of information which are to be collected in a tuberculosis survey are given in detail in the various schedules appended to this report. They vary with the type of survey undertaken.

(d) Organisation of Surveys.

Details for the organisation suggested for different types of surveys will be given, but in general it may be stated that before a survey is begun it must be carefully planned as regards organisation; from the beginning it is necessary to know what information will be collected, how it will be collected, for how long, what methods will be used for sorting and tabulation, what other sources of information will be utilised, and, in view of all this, what personnel will be required. It is also most important to arrange for the proper supervision, editing and verification of all the Schedules.

TYPE I SURVEY.

Objective.

To ascertain the distribution of tuberculous infection in a community with a view to obtaining a general idea of the tuberculosis problem and with a view to locating special areas or groups where further investigations are particularly needed.

Data to be collected.

The particular groups about which information would be of the greatest importance in a preliminary survey are :—

Race

Sex

Age

Habitat—Nature and duration, whether rural, semi-rural, or urban.

Occupation

Religion

Any obvious cases (though strictly not required for the main object of the survey, are noted for taking proper care of the patient and preventing further infection).

N. B. - The Schedule for Type I Survey is given in Appendix II.

Selection of area.

This survey is intended to cover a wide area such as a district or a large town.

An administrative district or a large town is a convenient unit for this type of survey. It would be of advantage if a plan was made for the whole Province or State, of which each Type I Survey may constitute a part.

Organisation.

This type of survey for a population of about 10,000 will not require a large staff and need not take more than a year to enable useful conclusions to be deducted.

Staff.

(1) A doctor to be in charge of the survey, of at least M.B., B.S., qualifications and who has had at least six months' training in the clinical and epidemiological aspects of tuberculosis. His duties shall be as follows :—

(i) Local charge of the survey.

- (ii) Propaganda.
- (iii) Local planning.
- (iv) House to house visiting for—
 - (a) filling up the schedules
 - (b) tuberculin testing and reading of results (*vide* Appendix IV)
 - (c) clinical examination of suspected cases.
- (v) Analysis and interpretation of data.
- (vi) Arrangement wherever possible for care and treatment of obvious cases.

(2) An assistant doctor, who may be a woman, and may be either of M.B., B.S., or L.M.P. qualification, who will generally assist and work under the direction of the doctor in charge.

(3) Two trained tuberculosis health visitors at least one of whom must be a woman, who shall prepare the ground, get the confidence and co-operation of each family and perform any other duties which may be assigned to them by the doctor in charge. A great deal of the success of the survey will depend on the work of these health visitors.

(4) A typist clerk.

(5) Two peons for odd jobs.

Equipment.

Tuberculin syringe—6, needles—24.

Tuberculin.

Thermos flask.

A few bottles.

Rectified spirit.

Cotton wool.

Spirit lamp.

Scalpels 6.

Record cards and index cabinet.

Stationery.

The total cost of this need not exceed Rs. 500

It would be an advantage to have available a microscope, slides and stains.

Procedure.

Before the enquiry is started the co-operation of local doctors, administrative officers and the public should be secured by personal interviews, publicity and propaganda some time ahead of the survey.

Before beginning work a detailed plan including selection of houses to be investigated should be made, keeping in mind the principles outlined in Section III b.

In filing records it will be an advantage to arrange the cards serially according to families and again serially in each family. If the survey is large it will have to be arranged in sub-areas.



TYPE II SURVEY.

Objective.

To ascertain the extent of infection, resistance, morbidity and mortality in a community; also the form and type of disease and the extent of known contact infection. The survey is also planned to give an idea of the conditions under which the infectious cases live.

This type of survey does not include investigation into auxiliary factors concerned in the spread of tuberculosis, but it may indicate the particular area or community in which such investigation may profitably be undertaken later.

Data to be collected.

In addition to the data given in a Type I Survey the following items are to be added in the Schedule :—

- (1) The presence of active tuberculosis.
- (2) The corrected tuberculosis mortality within the area or community for the last five years.
- (3) The X-Ray examination (mostly screening) of all positive reactors.
- (4) The history, symptoms, physical, X-Ray and laboratory examination of suspected cases whether tuberculin positive or not.
- (5) The relation of infectious cases to the community.
- (6) The extent to which home isolation of the infectious cases is feasible.

N. B. — The Schedule for Type II Survey is given in Appendix III.

Selection of area.

The area will be suggested by the results of the Type I Survey. It will be most profitable to select three areas or groups, one with a high degree of infection, one with a low degree and a third with an intermediate degree.

Organisation.

This type of survey can only be done in co-operation with a well-staffed and well-equipped tuberculosis clinic. The survey must be done from the clinic either by an additional special staff belonging to the clinic or by a special staff working in close co-operation with the clinic staff.

Staff.

In addition to the clinic staff:—

- (1) A doctor to be in charge of the survey, of at least M.B., B.S., qualifications and who has had at least six months' training in the clinical and epidemiological aspects of tuberculosis. His duties shall be :—
 - (i) All the duties given for the doctor in charge of a Type I Survey and in addition;
 - (ii) The X-Ray examination of all positive reactors.
 - (iii) The X-Ray, physical and laboratory examination of all suspicious cases.
 - (iv) The finding out of the infectious status of any patient.
 - (v) In co-operation with the clinic to arrange for the treatment and if possible isolation of detected cases.
 - (vi) The determination of the tuberculosis mortality for the area or community.
- (2) An assistant doctor who may be a woman, of at least M.B., B.S., qualifications and who has had at least six months' training in the clinical and epidemiological aspects of tuberculosis, who will generally assist and work under the direction of the doctor in charge.
- (3) Technical assistant for laboratory and X-Ray.
- (4) Two trained tuberculosis health visitors as in Type I Survey
- (5) A typist-clerk.
- (6) Two Peons.

Equipment.

It is expected that X-Ray and laboratory facilities, apparatus and equipment will be available in the clinic. In addition the equipment given under Type I Survey will be required.

Procedure.

The procedure closely follows that given under Type I Survey, and if a Type I Survey has preceded the Type II Survey much of the preliminary work will have already been done.

TYPE III SURVEY.

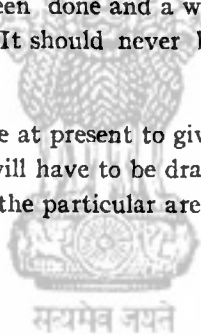
There are certain factors necessary for undertaking a successful Type III Survey :—

- (1) The existence of reliable statistics, medical and socio-economic, on an extensive scale.
- (2) Health agencies and services to provide relevant data.
- (3) A highly trained personnel which has had adequate training both in the principles and technique of epidemiological investigation and also in the diagnosis and treatment of tuberculosis.

In India these criteria are at present almost non-existent but by careful planning it may be possible to compensate to some extent in some areas for this lack.

A Type III Survey should only be done where Types I and II Surveys have already been done and a well equipped and properly staffed clinic is working. It should never be begun as an isolated investigation.

It would be premature at present to give detailed schedules for a Type III Survey; they will have to be drawn up from experience of Type I and II Surveys in the particular area to be surveyed.



TYPE IV SURVEY.

This type of survey can come only after various anti-tuberculosis measures, introduced either as a result of experience in other countries or as a result of a Type III Survey, have been working for a considerable number of years in a particular area. The assessing of the relative value of the various anti-tuberculosis measures has to be the work of a central body which has knowledge of the results of these anti-tuberculosis measures in various areas and not in the particular area alone.



TYPE V SURVEY.

In this type of survey it is very necessary to define exactly what are the problems to be investigated. When the problems have been so defined, the detailed implications must be worked out for the particular investigation and the enquiry must be organised accordingly.

It should be remembered that the best results will only be obtained if the staff employed is adequately trained for the particular type of investigation to be made; for example, in investigating the hazards of special industries special technical knowledge may be needed with regard to chemical or other processes involved. It would be a mistake to think that a doctor, however well-trained he might be in tuberculosis, would be always capable of undertaking such a survey by himself without special technical co-operation.



APPENDIX I.

SELECTION OF AREA OF POPULATION.

Obviously the best method of obtaining information regarding the conditions prevailing in a community will be to examine each individual unit constituting the community in respect of the characteristics involved. If this were done, the conclusions arrived could be applied with confidence to the community as a whole. However, as it happens, information has to be obtained on a large number of items and in respect of a large number of individuals which makes it difficult not only to arrange for the collection of the data with any degree of accuracy within the limits imposed by available funds and other facilities but also to analyse, digest and interpret the mass of information so collected. It, therefore, becomes necessary to confine the investigation to a portion of the community although it is intended that the general conclusions arrived at will be applied to the whole group. The question naturally arises to what extent this generalisation is justified. The answer to this question depends upon three things, *viz*, (1) the way the sample is taken, (2) the size of the sample in relation to the amount of variation amongst the individuals and (3) the way the results are interpreted.

Recent work in theoretical statistics has developed methods by which the conclusions arrived at from relatively small samples might approximate as closely as possible to those that really apply to the community as a whole but most of these methods are much too technical to be employed by the average health worker nor is it always necessary to use them. However, there are two fundamental concepts of sampling which anyone resorting to sampling must bear in mind, namely, (1) the sample must be representative of the population, *i.e.*, it should be so constituted as to include different categories of individuals in respect of the attribute under discussion in about the same proportion as they actually exist in the population and (2) the sample should be adequate in size because it has for instance been shown that the difference in the mean value of the population as a whole and the mean of the sample varies inversely as the square root of the number comprising the sample and since it is our aim to reduce this difference to the minimum so that the mean of the sample might approximate as closely as possible to the mean of the universe of description, the larger the size of the sample, other things being equal, the better this approximation will be.

Some general information about the gross variation in the population in respect of the characteristic under investigation is necessary. There are, for instance, reasons to believe that hill people are more liable to suffer from tuberculous disease when exposed to it than people in the plains and that city dwellers are as a rule less liable to contract the disease as compared with villagers. In taking the sample from a district consisting of hill area, towns and villages for purposes of estimating the incidence of the disease it would be necessary to divide the area into sub-areas of these three categories and assign an appropriate number to be included in the sample from each sub-area. Having done that every care should be taken to avoid any conscious selection because the introduction of any such bias will vitiate the representative character of the sample. How could this be done? We must necessarily resort to some such device as is employed in games of chance. We may for instance mark the houses and prepare little cards bearing corresponding signs. If we shuffle the cards properly and draw out the required number (*i.e.*, the number we wish to include in the sample) the resulting sample will be unbiased. To test the adequacy of number we may draw a number of independent samples and estimate their means. If the size is adequate the difference between their means will be insignificant.

Finally, there is the question of interpretation; this simply means that we should be conscious of the limitations as regards the applicability of the conclusions derived from the samples to the population as a whole. Here again we have to lean on theoretical considerations for guidance. Statistical methods have been devised to offer assistance in interpretation and it is recommended that before attempting to draw general conclusions one should consult books dealing with these methods or should enlist the collaboration of a statistician. Since we have seen that statistical considerations enter into the selection of samples it is necessary to collaborate with the statistician from the very beginning and throughout the investigation to avoid pitfalls and waste of time and energy.

APPENDIX II.

TUBERCULOSIS SURVEY COMMITTEE—I. R. F. A.

TYPE I SURVEY—GENERAL SCHEDULE.

I-IV ¹Serial No: V-VI ²Date VII ³Investigator VIII ⁴District

IX-X ⁵Village or Town XI-XII ⁶Sub-area XIII-XIV ⁷Family

Name Name of ⁸Father
Husband
Employer
Address

XV ⁹Resident or Visitor XVI Sex M F XVII ¹⁰Religion
I 2 I 2 H M C S B T P O
I 2 3 4 5 6 7 8

XVIII ¹¹Race Eup. A-I Non-E. F.
I 2 3 4 5 6 7 8 9 10
II 12 13 14 15 16 17 18 19

XIX ¹²Age—actual -1 -2 -3 -4 -5 -10 -15 -20 -25 -30
(Years) I 2 3 4 5 6 7 8 9 10
-35 -40 -45 -50 -55 -60 -65 65-
II 12 13 14 15 16 17 18

XX ¹³Occupation A₁ A₂ A₃ Ba Bb₁ Bb₂ Bb₃ Bb₄ Bc₁ Bc₂ Bc₃ Bc₄
I 2 3 4 5 6 7 8 9 10 11 12
C Da Db
13 14 15

XXI ¹⁴Habitat Unchanged R S U
I 2 3
Changed 4 5 6

XXII Duration - $\frac{1}{2}$ -1 -2 -3 -4 -5 5-
(years) I 2 3 4 5 6 7

¹⁵Tuberculin Test XXIII Type v Pirquet Mantoux
Original Retest (1) Retest (2)
3 4 5

		¹⁶			
XXIV	Dilution (O)	$\frac{1}{10,000}$	$\frac{1}{1,000}$	$\frac{1}{100}$	Other
		1	2	3	4
XXV	(R ₁)	1	2	3	4
XXVI	(R ₂)	1	2	3	4
	Date of Test	(O)	(R ₁)	(R ₂)	
	Date of Reading	(O)	(R ₁)	(R ₂)	
	Reaction—Size (m.m.)				induration erythema
	Intensity	—	+	++	+++
XXVII	(O)	1	2	3	4
XXVIII	(R ₁)	1	2	3	4
XXIX	(R ₂)	1	2	3	4
	Obvious Tuberculous Disease				
XXX	Pulmonary	nil	suspicious	diagnosed	
		1	2	3	
	Non-pulmonary	4	5	6	
	Under Medical Care		yes	no	
			7	8	

KEY AND EXPLANATORY NOTES TO TYPE I SURVEY.

GENERAL SCHEDULE.

The figures above the items, for example "Date"² refer to the Key and Explanatory Notes given below. The Roman capital figures and the figures below the items, for example "XV Resident or Visitor"¹ ² are for use in machine sorting.

Key.

Note.

1.

Since this number is the only means of identification of the individual for purposes of analysis it is absolutely necessary to avoid any possibility of confusion. The best way to ensure this is to avoid duplicate serial numbers relating to different individuals. It is, therefore, best to have *only one* continuous series of numbers in an enquiry: no new series being made for different villages or years. The most convenient method to secure this end is to have all blank schedule forms numbered before they are bound into convenient sized volumes. These volumes may then be issued to various investigators without any danger of reduplication of serial numbers.

2. Note the date of visit as also the week of the enquiry.

This refers to the date of visit to the individual concerned. In case it is intended to use this date for purposes of chronological arrangement, it will be found convenient to put down the week of the enquiry numbered serially since the date of commencement.

3. Serial number of the investigators.

Each investigator should bear a number. A list of names with corresponding serial numbers should be maintained in the survey office. In case a man leaves service in the middle of the enquiry or is on leave, the successor or substitute should be given another number.

Key.**Note.**

4. Note the name of the political administrative district and the number given to it.
5. Note the serial number given to the village or town.
6. Note the serial number of the sub-area of the town or village, such as a ward or para etc.
7. Family.
- 8.
- 9.
10. Hindus (H),
Muslims (M),
Christians (C),
Sikhs (S),
Buddhists (B),
Tribal religions (T),
Parsees (P),
Others (O).

A list of villages or towns with corresponding serial numbers should be maintained in the office.

A list of serial numbers of the sub-areas with the corresponding serial numbers should be maintained in the office. The object is to study the geographical distribution.

A family is defined as a group of individuals using a common kitchen. It includes servants and boarders. This term should not be confused with a house which may contain a number of families. Each family investigated should be given a separate number.

Domestic servants may be more readily identified through their employers.

This relates to the individual and not to the family or ancestors. If a person has been mostly out and comes home occasionally for a few days to keep up family connection he should be regarded as a visitor. Married daughters and children away at school should be regarded as visitors.

Modern education has a considerable standardising effect on habits of life but in the bulk of the population living conditions which influence tuberculosis problem are likely to vary with religious denomination.

Key.11. *Race* : -

Eup.—European
 A-I —Anglo-Indian
 Non E. F.—Non
 European
 Foreigners.

For other racial
 groups adopt sui-
 table abbreviations
 in the schedule ac-
 cording to local
 requirements.

Note.

It is generally accepted that racial factor is involved in relative susceptibility to tuberculosis. Race according to Sir Flinders Petrie "is a group of human beings, whose type has become unified by their rate of assimilation exceeding the rate of change produced by foreign elements." To classify a population into racial groups according to this definition would itself need a separate investigation. To begin with one might recognise three broad groups namely; foreigners, the primitive forest or hill tribes and the rest of the Indian population. The first group may be sub-divided into Europeans and Non-Indian Asiatics. Obviously these two sub-groups are not a correct description of racial characters, but for purposes of surveys in India any further divisions would not be of any great importance. In the second group are included such tribes as have not been materially influenced by the Aryan Civilisation and have not been properly absorbed into the 'Hindu Society'. These tribes are met with in different parts of the country and the names of the tribes residing in different provinces may be obtained from the provincial census reports. The third group which constitutes the bulk of Indian population presents considerable difficulty in classification. There are some aboriginal tribes which are easily distinguished. For the rest are their innumerable divisions which are not necessarily individualised on racial basis, other factors besides racial basis such as religion, occupation, geographical isolation and social, being involved in very complicated manner and these very often confuse the racial issue. The fusion of

Key.**Note.**

races again make the confusion worse confounded. For practical purposes amongst the Hindus the nearest approach to racial distinction using the term in the meaning given to it by Sir Flinders, is obtained by division into main castes. Amongst the Indian Christians apart from the greater amount of fusion of castes and of a tendency to discard the caste of origin it may in many instances be possible to allot a caste classification. This may also be possible amongst some sects of the Muslims though it is becoming increasingly difficult now. The names of the main castes may be obtained from the census reports for any given area. Too many sub-divisions should be avoided and individual judgement will have to be exercised in making local classification but the central idea should be to see the extent to which there is fixity of type in a group proposed to be constituted into a class.

12. Note the actual age in years and also the age group.

For the study of the tuberculosis problem classification into infants, children, adolescents, adults and old people will suffice. A small number of age groups will serve this purpose. However for purposes of calculating age specific rates it is necessary to adhere to the quinquennial or decennial groupings (with sub-groups in earlier age) according to census classification (*vide* subsidiary Table I, Page 98, Census of India, 1931, Vol. I, Part I.) The suggested classification will also enable a comparison to be made with other countries. The instruction to the enumerators of 1931 census were to note the age nearest birth date instead of the number of years completed as in previous

Key.**Note.**

censuses. In order to appreciate the errors in recording age and to avoid, if possible, some common mistakes, the investigator will do well to read Chapter IV in Census of India, 1931, Vol. I, Part I. For accurate work it will be necessary to apply the corrections suggested there in the formation of groups. If that is done one important statistical error in the calculation of age specific rates will be avoided.

13. Note the actual occupation as well as the group according to the classification suggested here.

The principles for classification may be stated as :—

- (1) opportunities which the occupation provides for exposure to infection;
- (2) effects of the occupation on resistance of the individual to infection or to disease;
- (3) opportunities which the occupation allows of transferring infection to others.

Keeping these principles in view we may group the detailed occupations given in the census under the following classes:—

A. Open-air life:—

- Hard physical work (A1)
- Moderate physical work (A2)
- Light physical work (A3).

B. Indoor life:—

- (a) Contact with patients (Ba)
- (b) Non-contact non-dusty :—
 - Hard physical work (Bb1)
 - Moderate physical work (Bb2)
 - Light physical work (Bb3)
 - Sedentary physical work (Bb4).

Key.

Note.

(c) Non-contact dusty :—

Hard physical work (Bc1).
Moderate physical work (Bc2).
Light physical work (Bc3).
Sedentary physical work (Bc4).

C. Transport and travelling.

D. Domestic and like occupation:—
Food handling (Da.)
Not food handling (Db.)

The difficulty in following census figures is that the division is made in the census tables on the basis of the source of family income. Thus the wives of wood cutters are classified under this category although actual occupation may be domestic. It is proposed, therefore, that the dependents or partial dependents should be put under appropriate class according to the principles enunciated above.

14. Habitat.

It is not always easy to decide whether a community is urban or rural. The Census Report, 1931, writes as follows :—

"Of a necessity the definition of a town for census purposes has resulted in a distinction which is sometimes arbitrary. Towns of not less than 1,00,000 inhabitants were to be treated as cities, and also any other towns which the Superintendent decided to treat as cities subject to sanction of the Local Government. But the Census Code further provided for the treatment as a town of every municipality, all civil lines not included in municipal limits, every cantonment and every other continuous collection of houses, inhabited by

Key.**Note.**

not less than 5,000 persons which the Superintendent of Provincial Census Operations decided to treat them as urban. In making this decision the Census Superintendent was instructed to take into consideration the character of the population, the relative density of the dwellings, importance in trade and historic associations, and to avoid treating as towns overgrown villages without urban characteristics.....

In this connection it will be well to bear in mind that the distinction between a small town and a large village, as far as the conditions of life or occupation of its inhabitants are concerned, is often meaningless, and the treatment of any place as urban rather than rural does not necessarily imply any degree of a corporate life distinct from that of the ordinary village.....

It is, of course, obvious that the composition of the truly urban population is likely to differ from that of the surrounding area. It is in the nature of things that the more varied activities of towns should attract a mixed population with less homogeneity than that of the country side."

Infection is considerably influenced by habitat. The criteria which bear on this are: -

- (1) Character of the population *i.e.* opportunities for non-familial contacts, relative isolation, movements and strain of modern life;

Key.**Note.**

- (2) relative density of dwellings affecting circulation of air and light;
- (3) type of house;
- (4) trade or industries.

In general the Census Report follows these criteria, but it has to be left to the investigator to decide the nature of the habitat in each individual case.

It is proposed to classify habitat in this type of survey into rural, semi-rural and urban. The influence of habitat will, however, depend on the period for which it has operated on the individual. Three factors are involved here namely: age, duration of present habitat and previous habitat. For a full analysis these three factors should be separately analysed. This would involve a complicated system of analysis, not required for this type of survey. It will suffice if only the first two factors are taken into consideration and a comparison is made of the three types of habitat with regard to infection rate with or without including the population which has changed its habitat. For purposes of comparison it is recommended that separate tables for each habitat according to age and duration of previous habitat may be prepared. Their perusal will convey a good impression of how habitat is operating on tuberculous infection although definite numerical appreciation will not be possible.

15. Tuberculin Test.

See Appendix IV.

16. O=Original test
R₁=First re-test

Punch only the result of the latest test in the Cope

[illegible]

DIRECTIONS FOR USE OF COPE CHAT PARAMOUNT SYSTEM CARDS FOR SURVEY TYPES I & II.

- (1) Each card represents one individual.
- (2) Where details are not shown in the card the numbers to be punched are those marked in the schedule under the respective items as suggested in the key.
- (3) Punch the data in appropriate marginal holes.
- (4) To save space, 9 figures in units of 10, 100 or 1,000 instead of being allotted 9 holes are allotted a set of 4 only and a combination of these can be used to make up any figure of the 9.

Thus punch

1 and 2 for 3
1 and 4 for 5
2 and 4 for 6
1 and 7 for 8
2 and 7 for 9

e. g. To obtain serial No. 9654

Punch in units 4
in tens 1 and 4
in hundreds 2 and 4
in thousands 2 and 7.

- (5) The other entries present no difficulty.
- (6) For analysis of any particular item the cards are packed in such a way that all cut-corners are superimposed.
- (7) To distribute the cards in respect of any particular items pass a needle through the appropriate hole, lift up the pack on the needle, and shake; the cards punched in that item will fall out. These are counted and the number recorded.
- (8) Wherever there is double punching (*i.e.* in all except Resident or Visitor, Sex, Tuberculin Test and incompletely used spaces) the needle will have to be passed more than once, to separate out all the groups.
- (9) In the tuberculin test, as also in the re-test if used :—
Punch the reaction for the highest concentration employed in the latest test.

APPENDIX III.

TUBERCULOSIS SURVEY COMMITTEE—I. R. F. A.

TYPE II SURVEY SCHEDULE

(Addendum to Type I Schedule, which should be attached to this Schedule when conducting Type II Survey)

1

XXXI-XXXIV *Serial No.* XXXV-XXXVI *Date* XXXVII *Investigator*

XXXVIII <i>Marital Status</i>	Unmarried 1	Married 2	Widower or Widow 3
-------------------------------	----------------	--------------	-----------------------

XXXIX	²										
Parity	0	1	2	3	4	5	6	7	8	9	9-
	1	2	3	4	5	6	7	8	9	10	11

	3			
Contact	XI,	Intimate	Close	Distant
		I	2	3
				4

Age at first contact (years)	-1	-1	-2	-3	-4	-5	-10	-15	-20
	1	2	3	4	5	6	7	8	9
-25	-30	-35	-40	-45	-50	-55	-60	-65	65-
10	11	12	13	14	15	16	17	18	19

XLII *Duration of contact* (years) $-\frac{1}{2}$ -1 -3 -5 5-
1 2 3 4 5

XLIII When contact ceased (years ago) $-\frac{1}{2}$ -1 -3 -5 5-

Clinical Examination

XLIV Onset Insidious		Acute	XLV <i>Duration of illness</i>		
1	2		(years from 1st. Sympt)		
			-1	-½	-1
			1	2	3
			-2	-3	-4
			4	3	6
			-5	5-	
			7	8	

Diagnosis	XI,VI	Pulm.	Tub.	Non-Pulm.	Tub.	Non-tub.
		I		2		3
		disease	No disease.			
			4			

<i>Pulmonary Tuberculosis</i>	XLVII	Open I	Closed 2
-------------------------------	-------	-----------	-------------

XLVIII Active Latent Healed			XLIX Unilateral Bilateral	
I	2	3	I	2

I, Prim. Infect Type Reinfest Type
I 2

L,I Local. Dissem. Miliary I,II Exud. Prod. Interm.
I 2 3 I 2 3

L,III Cavities Nil Single Multiple
I 2 3

L,IV Stage I II III L,V Pleurisy Nil With Effus. Without Effus.
I 2 3 I 2 3

L,VI Tuberc. Complications Yes No.
I 2

⁶
Non-pulmonary Tuberculosis

L,VII Gland Ost. art. Abd. G-u Skin Men. I,ar. Other.
I 2 3 4 5 6 7 8

Infectious Status

L,VIII Same Room Nil ⁷ A C I,IX Same House Nil A C
I 2 3 I 2 3

⁹
I,X House type det. S-det. cont. flat c-cy
I 2 3 4 5

¹⁰
I,XI Isolation poss. part. poss not poss
I 2 3

¹¹
Mortality

¹² ¹³
L,XII No. of deaths Adults
L,XIII „ Children

Age at death -I -5 -10 -20 -30 -40 -50 -60 60-

¹⁴
Duration of illness

¹⁴
Main Symptoms

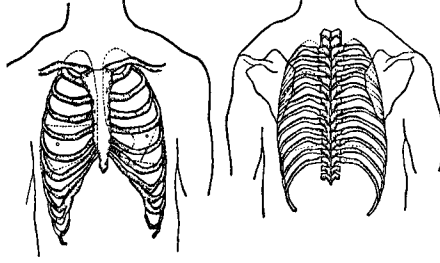
¹⁵
Deaths from tuberc.

L,XIV P. T. ¹⁵ d. d. T. B. + X-Ray + Susp.
I 2 3 4 5
Non P. T. d. d. T. B. + X-Ray + Susp.
6 7 8 9 10

Note: The tuberculin test performed during Type II Survey, should be recorded in Type I Schedule.

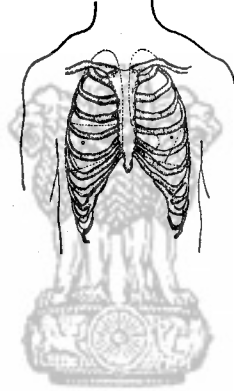
Physical Examination

Date

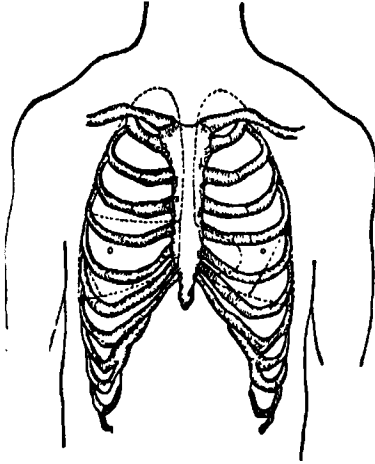
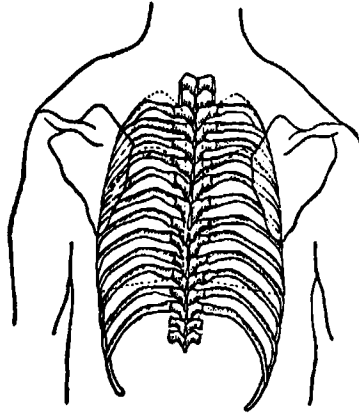
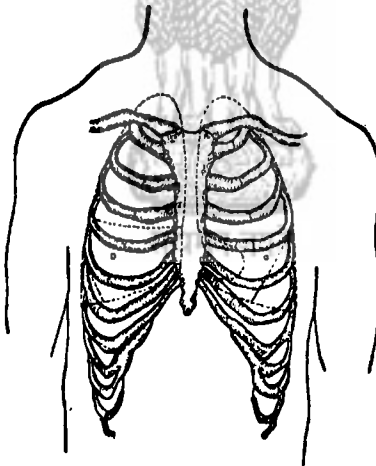


X-Ray

Date



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Physical Examination**Date****X-Ray****Date**

KEY & NOTES TO TYPE II SURVEY SCHEDULE.

Key.	Note.
1. Serial No.	Give the same serial number as borne on Type I Schedule for the individual concern.
2. Parity.	Parity includes still-births but not abortions.
3. Contact.	The intention is merely to obtain a rough estimate of history of contact. For the present purpose intimate contact will mean living in the same room with a patient; close contact will mean living in the same house or working in the same room; distant contact will signify occasional association with an outsider suffering from the disease.
4.	These are the results accruing from the history of the patient and from his clinical, X-Ray and laboratory examination. These entries should be made as soon as the period of initial examination has been completed.
5.	'Exudative' includes predominantly exudative; similarly productive includes predominantly productive; intermediate are cases in which the lesions are more or less equally of the two types.
6. Gland=Glandular Ost.art=Osteo articular abd.=abdominal g. u.=gentto-urinary mcn.=meningeal lar.=laryngeal	These are to be recorded only in cases in which active pulmonary tuberculous lesions are not present.
7. A Adult C Children under 15 years of age.	Note whether this individual in case he is diagnosed as an infective case is in close contact with a non-tuberculous person, adult or child.

Key.**Note.**

8. Same house.

A set of rooms having one or more common entrances.

9. Det=detached
S. det=-semi-detach-
cd
cont.=contiguous
c.cy=common court-
yard.

10. Poss=possible
part-poss=partially
possible
Not poss=not
possible.

Possible signifies isolation in a separate room or a separate verandah. Partially possible means cases in which, though separate accommodation can be provided, isolation is not satisfactory.

- 11.

This information relates to the history of the family to which the individual belongs, and as such would more properly be put in a separate family schedule. In order, however, to avoid multiplicity of schedules it has been included in the schedule relating to the individual. To avoid confusion this information should only be entered in the schedule bearing the first serial number in each family.

- 12.

Record mortality for all causes during the last five years after making corrections for residence, excluding the deaths of visitors, and including deaths occurring outside of members of the family normally resident.

13. A=adults
C=children under
15 years of age.

- 14.

This information will assist the investigator in obtaining correct information. It is not required for analysis. Enter the number of deaths if more than one death occurs in any age group.

Key.

15. P. T. = pulmonary tuberculosis
 d. d. = definitely diagnosed
 Susp. = suspicious
 Non p. t. = nonpulmonary tuberculosis
 TB+ = Tubercle Bacilli found
 X-Ray+ = Definite X-Ray evidence of tuberculosis.

Note.

'Definitely Diagnosed Pulmonary Tuberculosis' signifies disease which has been so diagnosed by a doctor wherever possible the confirmation of the doctor who treated or who saw the patient should be obtained. If for any reason it is impossible to obtain the direct confirmation of the doctor, the evidence of definite diagnosis of pulmonary tuberculosis by a doctor may be accepted from the family.

It is recognised that in this definition there is a possibility of mistake but the chances of error are not great, because these individuals have been seen by doctors before death when there was an opportunity to make a correct diagnosis.

As, however, it is expected that standards of diagnosis will improve, and more laboratory and X-Ray examinations will be made to confirm the diagnosis of tuberculosis, it should also be noted whether there is recorded evidence that Tubercle Bacilli have been found in the sputum or whether definite X-Ray evidence of tuberculosis has been found. By X-Ray evidence is meant at least a definite parenchymatous lesion of a tuberculous character specially in the upper half of the chest.

The term 'Suspicious Pulmonary Tuberculosis' will generally be accepted on the evidence of the family that the deceased had suffered from the symptoms of the disease including prolonged fever with chest symptoms or hæmoptysis of a teaspoonful or more.

COPE CHAT PARAMOUNT CARD

FOR TYPE II SURVEY

[illegible]

APPENDIX IV.**THE TECHNIQUE AND INTERPRETATION
OF TUBERCULIN SKIN TEST.**

A. Von Pirquet Test.

The Pirquet Test is very simple and is suitable for field surveys, whenever the more difficult Mantoux Test is not practicable.

The test is made on the flexor surface of the forearm, about two inches below the elbow. The skin is first cleaned with alcohol and allowed to dry. A small drop of Old Tuberculin is then applied to the skin and several well separated parallel scarifications are made through the drop, taking care to penetrate the epidermic layer down to the corium and to avoid bleeding. The arm should be exposed for at least 15 minutes to give time for absorption and to allow it to dry. No covering should be put over the scarified area.

The reaction should be read at the end of 48 hours and if negative, preferably again at the end of 72 hours. The Pirquet Test is interpreted in the same way as the Mantoux Test.

B. Mantoux Test.

The Mantoux Test is more accurate than the Pirquet test in that a known amount of tuberculin can be given and the dose be increased if desired. For this reason, a slightly larger number of reactors can be obtained than with the cutaneous test of Pirquet. It has been estimated by various workers that the Pirquet test is equivalent to 0.1 cc of a dilution of a strength between 1 in 1,000 and 1 in 10,000 administered intradermally, so that when a 1/10,000 dilution is used for the intradermal test, the Pirquet test may be more sensitive if a reliable brand of Old Tuberculin is used. By the intracutaneous method, any two successive tests, done in graded doses, can be compared, which is not possible with the cutaneous test. The International Standard Tuberculin is recommended for general use.

Technique of the test. Use International Standard Tuberculin or preferably the new Purified Protein Derivative (P.P.D. the active principle of O. T. isolated in pure form).

Use sterile Normal Saline or O. 2% Carbolised Saline for dilution in such a way that O. 1 cc contains the desired dose. Dilutions should be kept in the ice chest when not in use and never be employed when more than a fortnight old.

Dilutions.—The following dilutions are generally employed :—

1/10,000, 1/1,000, 1/500, 1/100, 1/10.

A well fitting 1 cc. syringe graduated in 1/20 cc. with a short bevelled intradermal needle is required. The syringe, once filled, holds fluid for 10 tests, the needle being merely wiped with cotton wool soaked in absolute alcohol or flamed between the injections. It is well to have a separate syringe for each dilution.

Injection.—Clean the front of the forearm with rectified spirit and allow it to dry. Stretch the skin by holding the forearm taut from below, select a point away from superficial veins, insert the needle into the dermis at the smallest angle possible with the bevel upwards and inject O. 1 cc of the dilution. The injection, if properly made, should raise a white bleb, on the surface of which the hair follicles are easily visible. Subcutaneous injections should be avoided as they may give rise to a general febrile reaction. No controls are necessary up to 1/100 dilution. In case of 1/10 dilution, it is better to keep a control with glycerinated veal peptone broth of the same strength, to avoid a typical non-specific reaction.

Dosage. The initial dose may be either O. 1 cc. of 1/1,000 dilution (which is sometimes called the 'standard dilution' or O. 1 cc. of 1/500, except for persons—

- (a) suspected of having bone, lung, joint, ocular and skin tuberculosis or in children with visible cervical nodes, ulcerations or discharging sinuses ;
- (b) who have had a recent hæmoptysis ;
- (c) who are home-contacts of tuberculous patients ;
- (d) where their attendance for further tests can be guaranteed ;
- (e) who are very young infants,

in which case it is advisable to employ 1/10,000 dilution or even higher.

Whichever dilution is employed, read the result at the end of 48 and 72 hours. If negative, employ the next stronger dilution at the last visit (*i.e.*, at the end of 72 hours). The delay between two tests should not be more than a week. In a large majority of cases,

a dilution of 1/100 suffices, but if this gives a negative result, a dilution of 1/10 may be employed as the practicable upper limit, as stronger solutions are likely to give non-specific reactions. In case of doubtful reactions, employ the next stronger dilution to settle the result. No test is complete without using the 1/100 dilution, especially for mass investigations, in cases where 1/1,000 dilution has given negative results.

Reading of the reaction. Reactions should be read at the end of 48 hours. If negative, they should be re-examined at the end of 72 hours, and if still negative, at the end of 96 hours, when a final opinion might be put down. To read, hold the arm slightly flexed at the elbow and in good light and look across the arm rather than down on it.

A test should be recorded as positive or negative to the given dilution. A positive reaction is indicated by œdema and redness around the site of inoculation. When in doubt, feel with the fingers and gently palpate between them. Its intensity is judged by the amount of œdema (its extent and thickness) and redness and by any elevation of temperature and malaise, if they occur. The area of redness is usually less important than that of œdema. In measuring the area of erythematous infiltration of the skin (as judged by palpating between two fingers), reactions with the greatest diameter below 5 mm. are regarded as negative. Four categories or degrees of intensity of the reaction are considered *viz*:

- One Plus (+) reaction = Slight but defined œdema raised 1 mm. above skin surface and not more than 10 mm. diameter in the largest axis.
- Two Plus (++) = Well defined œdema, raised somewhat more than 1 mm. above skin surface; diameter between 10-15 mm.
- Three Plus (+++) = More extensive œdema with diameter exceeding 15 mm. and thickness exceeding 1.5 mm. above skin surface; wide area of redness beyond but no vesiculation or necrosis of the skin.
- Four Plus (++++) = Characterised by extensive œdema redness, vesiculation and necrosis; may be associated with temperature and malaise.

Interpretation. A positive tuberculin test always means the presence of tuberculous infection.

The positive reaction has its chief value in infancy, when it is more likely to be associated with active tuberculous disease or with a condition which may progress into active tuberculous disease, which may lead to a fatal issue. The younger the age, the worse the prognosis.

An infant under 2 years showing a positive reaction, but without symptoms, should be kept under observation for some years on account of the possible development of clinical tuberculosis. Meantime the prognosis should be optimistic, though guarded. If, however, obscure and persistent symptoms like unexplained pyrexia or loss of weight are present, the origin might probably be tuberculous and a more serious view should be taken until time shows this to be unwarranted.

A positive reaction in a child aged 2-5 or even ten years with persistent symptoms should suggest that these symptoms are tuberculous in origin. A weightage towards positive significance in interpretation should be given in cases of children in rural and semi-rural areas. An infected or improperly immunised adult in a remote rural area in India may, however, behave like an urban child with regard to hypersensitiveness.

Where a patient over 5 years gives a positive reaction to a qualitative test, it must not be concluded that clinical tuberculosis is present. In such cases the positive reaction has its principal diagnostic value when elicited by quantitative intracutaneous tests made with weak solutions of tuberculin (*e.g.* by 1/50,000 and 1/1,00,000 dilution) especially in rural people or hill tribes and in dermatological conditions. Quantitative tests are of doubtful value for estimating the prognosis in clinical tuberculosis.

The principal application of tuberculin tests in clinical practice is to a negative diagnosis or the exclusion of clinical tuberculosis. Failure to get a positive reaction does not always exclude tuberculosis. In spite of harbouring living tubercle bacilli in the body, a negative test may be obtained where the dose of tuberculin has been too small to elicit a reaction or the reaction has been done during the ante-allergic period or where the immunity is depressed or absent in certain clinical conditions like acute infectious disease, pregnancy,

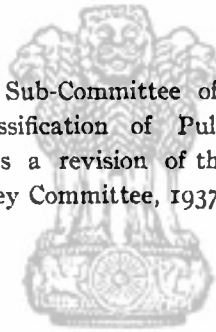
old age, cachexias and advanced tuberculosis a short period before death or in acute miliary or generalised tuberculosis.

Tuberculin tests are of great value in 'contact' cases both for detecting infection in infants and for excluding tuberculosis in these and older children. In testing contact children of tuberculous families, make routine tests on negative cases at intervals of six months, to determine the time when they are infected. Children still negative at 4-5 years may be given a good prognosis. The prognosis should be guarded when infants under 2 years react positively and when obscure symptoms persist for some time. A positive reaction in a young child aged 2-5 or even 10 years with persistent symptoms should suggest that these symptoms are tuberculous. About this age children who give a positive reaction to 1/10,000 or weaker dilution should be viewed with suspicion and should be X-Rayed. If impaired health and conspicuous underweight are noticed in these children, they should receive special care in diagnosis and treatment. If several positive reactors are found among the children in a family, suspect a 'carrier' in the house.

N. B.—The international Standard Tuberculin is available at the following places :

Beckenham (England)	Wellcome Physiological Research Laboratories (Depot in Bombay).
Hampstead (London)	National Institute for Medical Research.
Paris	Institut Pasteur.
Copenhagen	Statens Serum Institute.
Frankfort-on-Main	Stealiches Institut for Experi- mentella Therapie.

The Report of the Sub-Committee of the Tuberculosis Association of India on Classification of Pulmonary Tuberculosis is appended to this Report as a revision of the corresponding sections of the Report of the Survey Committee, 1937.



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REPORT
OF
SUB - COMMITTEE
ON
CLASSIFICATION
OF
PULMONARY TUBERCULOSIS



Members :

DR. C. FRIMODT-MÖLLER, C.B.E. (Hon.), M.B., Ch.B. (Copenhagen), *Chairman*,

MAJOR (J. F. TAYLOR, I.M.S.

DR. A. C. UKIL, M.B., M.S.P.E., F.S.M.F., F.N.I.

DR. P. V. BENJAMIN, M.B., B.S., (Madras), T.D.D. (Wales).

DR. B. K. SIKAND, M.B., B.S., (Punjab), D.P.H., (London).

MR. R. M. BARTON, M.A. (Oxon.),

...

...

Secretary,

PREAMBLE

In making the recommendations which follow in this Report, the Committee has tried to keep in view the requirements of the various types of tuberculosis institutions in India at the present time, and has attempted to suggest a method which is easy of uniform application by all. The Committee fully realises that when sufficient experience has been gained of the working of the standards suggested, further improvements may be made.

If an institution desires to use more detailed classifications, there is nothing to prevent this being done. The Medical Commissioner to the Tuberculosis Association of India would be grateful for a report of investigations into any such classifications, as they may be taken into consideration if after some years a revised classification is thought necessary.



REPORT ON CLASSIFICATION OF PULMONARY TUBERCULOSIS.

It is recommended :

(1) That in classification there should be taken into account both the anatomical extent of the disease as judged by physical and X-Ray examination, and the degree of systemic disturbance as judged by constitutional symptoms and blood examination ;

(2) that classification should be according to three stages with the sub-divisions A, B, C, denoting the degree of systemic disturbance ;

(3) that patients should be classified according to this scheme within the first month of treatment ;

(4) that within this classification patients should be divided into two main groups, those in whom tubercle bacilli are found, those in whom no tubercle bacilli are found, any time before or during treatment until discharge ;

(5) that some may desire to make further sub-divisions of patients into two groups, according to the history, 'Acute-Initial' and 'Chronic Recrudescant', but that at this stage in India this may not be possible as a general procedure. By the term 'Acute-Initial' is meant cases with an acute onset, a course of illness more or less continuous, without healthy intervals, with a duration not exceeding two years. By 'Chronic-Recrudescant' is meant cases slowly evolutive with healthy intervals, and cases of 'Acute-Initial' group with a duration of illness of more than two years.

For the purpose of recording the anatomical extent of disease determined either by physical or X-Ray examination, or by both, we suggest that the lung area should be divided into six zones, Upper, Middle and Lower Zones in each lung *

(1) Upper Zone.

The Upper Zone is the part of the lung above a horizontal line running from the lower border of the anterior and of the second rib round to the spine of the 5th dorsal vertebra, the patient being in the erect position. In this area the *apex*, is the part of the lung above the clavicle with the patient in the erect position and the shoulders not elevated.

* If X-ray is not used, this should be noted in reporting extent of disease.

(2) Middle Zone.

The Middle Zone is the part of the lung bounded by the above line and a horizontal line running through the lower border of the anterior end of the fourth rib round to spine of the 9th dorsal vertebra.

(3) Lower Zone.

The Lower Zone is the part of the lung below the Middle Zone.

I. The Stages of Classification are then as follows :—**STAGE I.**

A lesion affecting not more than one zone or if there is a lesion overlapping two zones the extent of the total lesion should not cover more than one zone. If there is bilateral affection it should be grouped in this stage only if the lesion is not below the clavicle on one of the sides and the total extent of the lesions is less than one zone.

No cases with cavities should be grouped in this stage.

If there is complete pneumonic consolidation of one zone, even if it is confined to one zone only, it should be grouped in Stage II.

STAGE II.

In unilateral disease the lesion should not extend to more than two zones. In bilateral disease the lesions should not extend more than one zone on each side, and the total extent should not be more than the equivalent of two zones.

If there is cavitation, it must be limited to a single cavity the diameter of which is not more than 2 c.m. If there is no X-Ray, all cases with cavitation should be placed in Stage III.

If two zones are completely consolidated, even without cavitation, the lesion should be grouped under stage III.

STAGE III.

All lesions more advanced than those grouped under Stage II, and all with a cavity larger than 2 c.m. in diameter, or with multiple cavities.

. All cases with spontaneous pneumothorax associated with an active tuberculous lesion in the lung.

In addition to the above primary considerations according to the lung lesion, *complications* both tuberculous and non-tuberculous have to be taken into account.

Such *tuberculous* complications as laryngeal tuberculosis, tuberculous enteritis, extensive tuberculous, osteo-articular tuberculosis, renal tuberculosis, pleurisy with effusion, polyserositis and meningeal tuberculosis, and such *non-tuberculous* complications as diabetes, kala-azar and pregnancy, must be taken into consideration in classification. Patients with these complications are generally put one stage down; for example, a patient classified as Stage I according to the anatomical extent of the lung disease would be classified as Stage II if he has also laryngeal tuberculosis.

If the complication is very severe or if there is more than one complication, the patient is classified as being in Stage III.

The degree of systemic effect should be noted at the end of one week's observation, after which the stages should be sub-divided into A, B, C.

A.—Constitutional disturbances, absent or slight, as judged mainly by temperature, pulse rate, influence on nutrition and strength, wasting, the sedimentation rate and blood picture. As regards temperature, the average maximum in the evening over a period of one week after half an hour's rest in bed should not exceed 99° F. oral or 99.8° F. rectal; the average pulse rate over a period of one week should not ordinarily exceed 90 per minute; the sedimentation rate and blood picture should not show marked variation from the normal.

B.—Constitutional disturbance moderate, *i.e.* intermediate between A and C. No serious complications affecting any organ or tissue seriously impairing function, local or constitutional.

C.—Severe constitutional disturbance. The average of the maximum temperature over a period of one week with the patient at rest exceeds 100.4° F. oral or 101° F. rectal; the average pulse rate over a period of one week exceeds 96 per minute; the sedimentation rate is high and the blood picture considerably deviated from normal.

II. Classification of Results of Treatment at the Time of Discharge.

These should be expressed in the following terms:—

(1) Arrested.

No clinical symptoms of active disease; no Tubercle Bacilli in the sputum for the last three months*; stethoscopic examination showing no signs of active disease (no persistant rales); X-Ray examination showing lesions apparently healed; sedimentation rate and blood picture normal or nearly normal; the patient able to walk at least two miles twice a day over a period of at least one month without any adverse effect.

(2) Quiescent.

No clinical symptoms of active disease; no Tubercle Bacilli in the sputum for the last three months; there may be slight cough and moderate expectoration; stethoscopic examination usually showing no rales, although a few rales and rhonchi may still be present; X-Ray examination should show lesions apparently healed. Sedimentation test and blood picture normal or nearly normal; the patient able to walk 1½ miles twice a day over a period of at least one month without any adverse effect.

(3) Much Improved.

No clinical symptoms of active disease; the sputum ordinarily free from Tubercle Bacilli for the last three months (slight cough in the morning with moderate expectoration or the finding of a few tubercle bacilli does not preclude being in this category if other improvements are maintained); stethoscopic examination showing signs reduced as much as could be expected in each individual (in some cases a few rales and rhonchi may still be present); X-Ray examination showing lesions apparently healed or considerably improved and any cavities healed or much reduced with thick fibrotic walls; sedimentation rate and blood picture normal or nearly normal; the patient able to walk at least one mile twice a day over a period of at least one month without any adverse effect.

* Before the sputum is declared negative, it should have been examined on four separate days in each of three months, using the ordinary smear method. It is, however, strongly recommended that culture methods should be used when no Tubercle Bacilli are found by the smear method. In all reports from institutions it should be stated, when giving figures for positive or negative sputum examination, whether culture methods have been used.

(4) Improved.

Clinical symptoms considerably improved; sputum may still show Tubercle Bacilli; stethoscopic examination showing signs improved; X-Ray examination showing improvement; sedimentation rate and blood picture improved; the patient ordinarily out of bed and able to walk at least two furlongs twice a day over a period of at least one month, without a set-back.

(5) Stationary.**(6) Worse.****(7) Died.****III. Classification of After-Results.**

The expression "Apparently Cured" is not mentioned in the Classification of Results of Treatment at the time of discharge, as this classification can only be made after two years observation of the patient living under ordinary conditions of life. During this period the patient should have maintained the conditions detailed under "Arrested".



APPENDIX I.

CLASSIFICATION OF PULMONARY TUBERCULOSIS.

RADIOGRAPHY OF THE LUNG.

The examination of the lung consists of two parts, which are complementary to each other :—

A. Fluoroscopy.

The following are among the important observations needed :—

- (1) Movements of the diaphragm, general and local.
- (2) The outline of the cardio and costo-phrenic angles.
- (3) The retro-cardiac space.
- (4) The action of the heart.
- (5) The lung fields and their illumination.

In order to effect these examinations, it is necessary to rotate the patient to suitable positions.

B. Radiography.

The technique of X-Ray exposure has to be standardised. This will vary with each apparatus. The following facts should be taken into consideration for obtaining a good result.

The criterion of an accurate chest film is the clearness with which the fine details of the vascular arborisation of the lungs are brought out. This enables the extent and character of a lesion to be appraised. In such a film, the vertebral bodies should not be seen distinctly through the cardiac shadow.

The normal postero-anterior skiagram should be taken, if possible, with the patient, erect, facing the film. The shoulders should be equidistant from the film and the clavicles parallel to it. In order to throw the scapulæ off the lung fields, the arms are held "akimbo", with the backs of the hands on hips and the elbows forwards and the chin erect and forwards. Exposure is made in moderately deep inspiration. It may occasionally be necessary, particularly when a shadow lies under that of a rib, to take skiagrams in both inspiration and expiration,

Among technical factors, the following should be remembered :—

(a) **Distance**—The focal-spot-to-film distance should be 5 feet. 3-4 feet with portable plants. Distances below 4 feet are less satisfactory in practice. The tube should be centred at the level of the fourth rib anteriorly or mid dorsal at back.

(b) **Time**—The technical factors should be such as to produce an exposure in less than a quarter of a second; exposures of $\frac{1}{8}$ sec. or less are preferable. The shorter the exposure, consistent with adequate photographic results on the film, the better.

(c) **Penetration and milliamperage**—The X-Ray tube current should be as high as the plant will permit. Ordinarily for chest exposures, the K. V. Peak varies between 50-80. For an average Indian adult of 150 lbs. the exposure for a postero-anterior skiagram should be 25 milliamperes/seconds using a Peak K. V. of 53 at 5 feet.

It is obvious that for larger patients this exposure will have to be increased. In this respect it is better to keep the factors of distance, milliamperage and time constant and to have only one variable, that is to say, penetration or K. V. For a patient of average build weighing 200 lbs. for example, this penetration will have to be increased by 12 K. V. The Radiologist will use his judgement and experience in determining how much or how little he should vary his penetration in each case, *e.g.*

For a patient of 100 lbs.	deduct 8 K.V.P.
„ „ 125 „ „	4 K.V.P.
„ „ 175 „	add 6 K.V.P.
„ „ 200 „ „	12 K.V.P.
„ „ 225 „ „	16 K.V.P.
„ „ 250 „ „	22 K.V.P.

For infants—deduct 15 K. V. P. or give $\frac{1}{4}$ exposure, preferably the latter where immobilisation is impossible.

For children—deduct 10-12 K. V. P. or give half the exposure.

Attention should be paid to the type of chest, for example, the relatively small lungs contained in the thick muscular chests of hypersthenic type of adults will require more penetration.

A single postero-anterior film may not elicit all the information wanted. A standard exposure may not bring out details in the diseased portion of the lung, such as thickened pleura, thick exudates,

fibrosis, size, position and depth of cavities etc. Special exposures in different positions have to be given in these cases, according to requirements. For example, for the lateral view, the patient should stand in the true lateral position, right or left as the case may be, with his arms folded above his head. Exposures in the lateral view for an average patient of 150 lbs. are of the order of 30 M. A. S. at 75 K. V. P.

The apical regions are not well shown in the ordinary lateral view, because the shoulders obscure them. To enable the antero-posterior depth of an apical lesion with more accuracy, a lateral view of the lung apices may be taken where necessary. The patient stands with the side to be examined towards the screen and raises this arm above the head. The other arm is lowered to the side. The patient then leans sideways towards the tube. The central ray enters above the clavicle and emerges through the axilla of the side to be examined. The nearer apex is thus projected above the other and not superimposed upon it.

Where the patient is unable to stand, he should be examined in the prone posture, the scapulae being retracted, as usual, as far as possible. The same factors of technique should be used.

For purposes of comparison, the same intensifying screen and the same quality of film should be used each time, in order to produce skiagrams of the same contrast and definition. In adjusting the technique of exposure, changes in body weight which have taken place in the meantime should be taken into consideration.

Development technique.

This should be standardised as far as possible. For a properly exposed film, using the standard developer made by Messrs. Kodak or Ilford, the time of development is 5 minutes at a temperature of 65°F. The developing solution should be of the same composition and should be frequently changed. The maker's direction in this method should be followed. Some of the recent developers take 3½ min. at 65°F.

Reporting of chest skiagraphs.

The radiological report should be descriptive rather than interpretative. One should first record in clear and simple form what the skiagram reveals to the eye. Then and then only should an attempt be made to draw a conclusion as to the pathological significance of the skiagraphic appearances thus recorded. The interpretation

should be done by a clinician or in consultation with a clinician, who should take into consideration facts revealed by other methods of examination.

The position of the patient and the tube distance should be noted. The localisation of the lesions in lungs is to be noted according to the sub-divisions or zones indicated under "classification of stages" in this memorandum. The *apex* may be defined as that portion of the lung seen above the level of the clavicle, when the skiagraph has been taken in the postero-anterior position. As confusion is likely to arise in describing *basal* lesions, the use of the word "base" in radiological report should be abandoned. The position of the trachea, mediastinum, diaphragm, heart and aorta should also be noted.

Granted that a descriptive form of report is to be employed, it is necessary to define certain terms to signify an uniform connotation. A *shadow*, *opacity* or an *area of diminished translucency* may be diffuse, localised or circumscribed; discrete or confluent; homogeneous, patchy or mottled. It may be branched or reticulated. The edges of a shadow may be ill or well-defined. The shape, size, position, number and density of such shadows may be recorded. An opaque area may have a translucent core. The word "*mottling*" may be described as a fine intermingling of opaque and non-opaque areas. *Areas of increased translucency* may be general or local. The use of the word "*infiltration*" should only be permissible as an interpretative term. "*Collapse*" should only be employed to describe the visible diminution of volume of lung tissue which is recognizable in pneumothorax, thoracoplasty or analogous procedures. Caution should be exercised in interpreting skiagraphic appearances as due to "*fibrosis*". The term "*peribronchial fibrosis*" should be abandoned.

The clinician's report should describe whether a lesion is "exudative", "productive", or "fibrotic." The term "exudative" means a homogeneous opacity in the pulmonary parenchyma with blurred ill-defined borders. The term "productive" implies small round or comma-shaped foci of a moderate degree of radiographic density. In fibrotic hopsirla type of lesion, dense striatns ory demarcated shadows are present. As the different types of changes are often present in a mixed form in a case, the interpreter has to use composite terms like "predominantly exudative", "predominantly productive" or "intermediate" according to the character of the lesion. When secondary changes occur, the terms "caseous", "cavity", "fibrosis" and "calcification" may be used. The term "caseous" indicates softening

in an area where exudative changes are present. The term "cavity" indicates the loss of lung substance with or without defined borders. The number, size, thickness of walls and presence of fluid level of such cavities should also be noted.

The following form of report based on that adopted by the Joint Tuberculosis Council, England, (*vide* Brit. Journ. Radiology Aug. 1939) is recommended for adoption as a convenient one :—

Hospital

..... Dispensary.

Name..... Age..... Date.....

X-Ray No..... Position.....

Screen Examination :—

FILM :— Tube distance :

Diaphragm
Position

Heart Size
Shape

Aorta

Trachea
Right

Hila
Left.



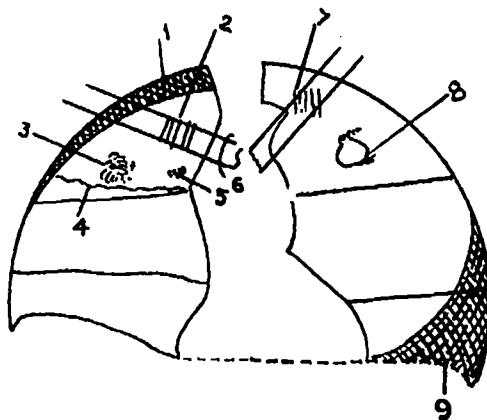
EXAMPLE : A case of Tuberculosis.

R. LUNG.

1. Homogeneous opacity (thickened apical pleura).
2. Dense mottling.
3. Discrete mottling.
4. Displaced interlobar fissure.
5. Calcified gland.
6. Displaced trachea.

L. LUNG.

7. Discrete mottling.
8. Cavity with fluid level.
9. Homogeneous opacity (pleural effusion).



Mediastinum.

Trachea.

Lungs :

Other abnormalities :

Conclusions :

Date.....

Radiologist.....

SYMBOLS FOR USE IN SCHEMA.

These should be few in number. The following are suggested as suitable :—



Homogenous opacity.



Dense mottling (more shadow than air).



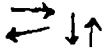
Discrete mottling.



Cavity without fluid level.



Cavity with fluid level.



Signifying displacement, *e.g.* mediastinum, trachea, interlobar fissures, etc.

Calcification.

APPENDIX II.

SPUTUM EXAMINATION FOR TUBERCLE BACILLI.

In order that the results of examination of one institution may be compared with those of another it is recommended that certain minimum standards should be adopted in the examination of sputum for tubercle bacilli.

Direct Smears.

Smears made preferably from sputum coughed out in the early morning should be prepared with due care as to choice of the part of the sputum taken for smearing. A modification of Ziehl-Neelsen's method with picric acid 1% in distilled water as a counterstain, is recommended.

A slide should be examined by a trained microscopist for 5 minutes using a magnification of approximately 500 to 600 diameters, before a report of 'no tubercle bacilli found' is given (or 200 fields may be examined).

If negative, a sputum should be examined by direct smear on four different days, if possible within a week, before proceeding to other methods.

Since there are micro-organisms other than tubercle bacilli which take the acid fast stain, care should be taken that only bacilli which are typical in shape and staining are reported as tubercle bacilli. If three or less acid fast bacilli are found, a positive report should not be made, only a report stating one, two or three acid fast bacilli found.

Concentration Methods.

Where direct smears are negative a concentration method should be employed. If the sputum is scanty, it should be collected for 24 hours. There are many concentration methods but the two following are simple and easily employed :—

Alkali Method.

Equal parts of sputum and 4 % sodium hydroxide are well mixed and left to stand for 20-30 minutes at room temperature being shaken occasionally until the mixture is homogeneous. Homogenisation may be hastened in cooler parts of India or in the cold season

by placing the mixture in the incubator at 37 degrees centigrade. The mixture is then centrifuged at approximately 3,000 revolutions a minute for 20 minutes. (This cannot be done by a hand centrifuge). The sediment is neutralised to litmus by the addition of a few drops of 8 % hydrochloric acid. The solution becomes white or opaque when neutralisation is complete and then no fixative is needed for the slide.

Acid Method.

Equal part of sputum and 6 % sulphuric acid (by volume) are well mixed and left for 20 to 30 minutes, incubating if necessary, as for the alkali method. After centrifuging at high speed for 20 minutes the sediment is used for making smears. This method gives rather more sediment than the alkali method which is some disadvantage if only smears were made, but is not a particular disadvantage if cultures are also to be made.

The standard of microscopic examination is the same as for direct smears.

Culture Method.

If smears are negative by the concentration method, cultures should be done wherever possible.

The sputum is concentrated by either the alkali or acid methods and in addition to slides being prepared, cultures are also put up from the same sediment. One of the more sensitive modern media should be used such as Lowenstein's (Jensen's modification) or Petraghani's or Petrik's. Some workers prefer to use two different media. At least six tubes are prepared from each specimen. The cultures are seen each week and a final report may be given at the end of six weeks.

Stomach Wash Method.

If the sputum is negative for tubercle bacilli or if sputum is absent or difficult to obtain, as in children and some women, the stomach wash method may be used. In the early morning the contents of the fasting stomach are removed with a Ryle's tube about 200 c. c. of sterile water may first be injected through the tube. The stomach wash water is allowed to settle and the sediment is treated and concentrated by the acid method, and smears or cultures are made.

APPENDIX III.

BLOOD EXAMINATIONS IN TUBERCULOUS PATIENTS.

The blood examinations which are of most use in the treatment of tuberculous patients are the Sedimentation test and the Leucocyte Count. Neither is of much help in diagnosis but both when frequently repeated are of great use as a guide during treatment and also in prognosis when the diagnosis has been established.

Sedimentation Test.

There are several methods of doing the sedimentation test such as Westergren, Cutler and Wintrobe and Landsburg. The differences in technique concern the amount of blood taken, the proportion of blood and citrate, and the time of reading the test.

Westergren's technique is recommended as being simple and the widest used. Glass tubes with an even bore of 2.5 m.m. and graduated from 0 to 200 m.m. at the tip are used. In a 2 c.c. syringe 0.4 c.c. of 3.8% sodium citrate is taken and into this is drawn 1.6 c.c. of blood from an arm vein, making a total of 2 c.c. of citrated blood. A little air is drawn into the syringe and it is well shaken to mix the citrated blood. The citrated blood is put into a small test tube and then sucked up into the sedimentation pipette and placed vertically in the sedimentation rack. The reading of the red cell level is taken at the end of one hour.

Normal for men	up to 7 m.m.
„ „ women	up to 10 m.m.

Variations from normal :—

A slight	15-40 m.m.
B Moderate	40-80 m.m.
C Severe	above 80 m.m.

Exceptions may be found, *e.g.* when a very sick person may have a low sedimentation rate.

Leucocyte Counts.

The leucocyte counts include an absolute count, a differential count and a count which takes into consideration the differentiation of the neutrophiles.

The differentiation of the neutrophiles is judged according to the segmentation which has taken place in the nucleus. The

Von Bonsdorff count is the sum of lobes in 100 consecutive neutrophils, the normal figure being above 275. The *Schilling Count* makes no distinction after segmentation has once taken place. The Stabkernige cells are the horse-shoe, band, or 'S' shaped nuclear cells without segmentation.

The standard which should be accepted in judging segmentation of the neutrophils, whether in the Von Bonsdorff Count or in the Schilling Count, should be that of Cooke. "If there is any band of nuclear tissue except in chromatin filaments connecting the different parts of the nucleus, the nucleus cannot for the purpose of the Arneth count be said to be divided."

Indices.

Some workers have found a great help in using a tuberculosis Index. Among these, three may be mentioned—Medlar's, Houghton's, and Frimodt-Møller and Barton's.

Medlar's Index.

This is calculated from the lymphocytes and monocytes as follows :—

$$\frac{\text{Mono}}{\text{Lymph} + \text{Mono}} \times 100$$

Normal about 10

Variations from normal :—

A Slight	20 and under
B Moderate	21 - 50
C Severe	51 and above.

Houghton's Index.

This is made up as follows :—On one side are placed what are grouped as 'positive' factors in favour of the patient, namely the Von Bonsdorff Count, lymphocytes and eosinophiles, and on the other side 'negative' factors against the patient, —the sedimentation rate, the neutrophils and the monocytes. His index is then :—

$$V. B. \quad - \quad [S R + \{ P + M - 2(L + E) \}]$$

V. B.	=	Von Bonsdorff Count
S. R.	=	Sedimentation rate
P	=	Polymorphonuclear neutrophils
M	=	Monocytes
L	=	Lymphocytes
E	=	Eosinophiles.

The lymphocytes and eosinophiles are considered both in relation to the neutrophiles and also to the monocytes and so are included twice.

The normal Houghton's Index is between 260 and 300.

Variations from normal :—

A Slight	250—200
B Moderate	200—100
C Severe	100—0

Frimodt-Møller and Barton's Index.

This index is based on the use of the Schilling differentiation of the neutrophiles.

The index is made up of four factors :—

- (1) The neutrophile percentage—lymphocyte percentage :—
(N—L)
- (2) The monocyte percentage—lymphocyte percentage :—
(M—L)
- (3) The percentage of neutrophils of stabkernige form :—
 $\left\{ \frac{\text{Stab}}{N} \times 100 \right\}$
- (4) The sedimentation rate (Westergren) in one hour expressed in percentage :—
 $\frac{SR}{2}$

An increase in any of these factors is against the patient, and a decrease in favour.

The index is expressed as follows :—

$$(N-L) + (M-L) + \left\{ \frac{\text{Stab}}{N} \times 100 \right\} + \frac{SR}{2}$$

$$\text{or } N+M + \left\{ \frac{\text{Stab}}{N} \times 100 \right\} + \frac{SR}{2} - 2L$$

A normal index is between -20 and +20.

Variations from normal :—

A Slight	21—75
B Moderate	76—150
C Severe	151 and above.

Certain conditions should be observed in all blood counts :—

(1) For purposes of comparison it is best to have all blood examinations made as far as possible under similar conditions, preferably at about the same time of the day.

(2) All blood smears should be made by an experienced technician.

(3) As far as possible one person should be responsible for the blood counting and that person should be a trained person.

(4) Never less than 200 cells should be counted. It will give less error if 400—500 cells are counted.



APPENDIX IV.

THE TAKING OF TEMPERATURE IN TUBERCULOUS PATIENTS.

(1) The temperature should be taken only with a reliable thermometer, preferably one which has been recently tested against a standard thermometer. It should be remembered that a thermometer once correct does not always remain correct and may even show one or more degrees variation from the standard after some time.

(2) The rectal temperature is the most reliable one in recording the temperature in tuberculosis and is to be preferred except when any special complication prevents.

(3) The temperature should be taken at the same times each day. The early morning temperature is taken just after the patient wakes and before he leaves his bed for any purpose. Usually the temperature taken three other times later in the day are, with the waking temperature, sufficient to give the daily range of temperature change but occasionally it may be necessary to take the temperature at other times as well. Rest temperature should always be after 20-30 minutes' rest in bed.

(4) In taking the rectal temperatures the thermometer, after being smeared with a little vaseline, is inserted into the rectum to a depth of $1\frac{1}{2}$ to 2 inches and kept there for five minutes (even if the thermometer is a $\frac{1}{2}$ minute thermometer). After being wiped with cotton soaked in lotion the thermometer is read and the mercury then shaken down.

(5) If oral temperature is used, the thermometer should be left under the tongue with the mouth closed for at least 7 minutes. During this time the patient should not speak, and immediately before he should not have taken any hot or cold food or drink.

(6) Difficulties may occasionally be experienced in the hot weather in India owing to excessive air temperature being above that of the patient's temperature. It is sometimes possible to cool the thermometer in water, shake down the mercury, quickly insert it in the rectum or place it under the tongue and at the end of the time read it quickly.

(7) Axillary temperature is not recommended as the thermometer has to be kept for fully 15 minutes under the axilla and the axilla must be quite dry — a condition not always possible in India.

Inguinal temperature is as unreliable as axillary temperature.

TESTING THERMOMETERS.

Testing a thermometer with a standard thermometer cannot be done in a small volume of water such as a tumbler, as variations in air temperature may cause variations in different parts of the water in the tumbler even up to $\frac{1}{2}$ a degree or more. A large volume of water should be used, such as a deksha, and after stirring the water well the thermometers should be placed in the centre not touching the bottom.

If a standard thermometer is not available, several thermometers of a reliable make should be used and any thermometer varying from the average more than 0.2 degree should be discarded for use on tuberculous patients.

